**Paying for outpatient care in rural China: Cost escalation under China's New Cooperative Medical Scheme**


## Abstract

China's New Cooperative Medical Scheme (NCMS), a government subsidized health insurance program launched in 2003 in response to the deterioration in access to health services in rural areas. Although the scheme was initially designed to cover inpatient care, it has started to expand its benefit package to cover outpatient care since 2007. The program's impacts on outpatient care costs have raised growing concern since the new initiative was launched, in particular regarding whether it has in fact reduced out-of-pocket (OOP) payments for services among rural participants. This study examines the impacts of the NCMS on outpatient costs by analysing data from an individual level longitudinal survey—China Health and Nutrition Survey (CHNS) of 2004 and 2009. This study adopted various health econometrics strategies, such as Two-Part Model (2PM), Heckman Selection Model (HSM) and Propensity Score Matching (PSM) with Differences-in-differences (DID) model to estimate the impacts of the NCMS on per episode outpatient cost using the CHNS of 2004 and 2009. We find that NCMS had little impact on reducing the NCMS patients' OOP payments for outpatient services and may also have contributed to an observed increase in the total per episode of outpatient costs billed to the insured patients. This increase was more pronounced among village clinics and township health centres—the backbone of the health system for rural residents—than at county and municipal hospitals.

## 1. Introduction

The dismantling of collective farms during the 1980s led to the demise of the Cooperative Medical Scheme (CMS), which had provided 90% of rural population with access to basic healthcare (Liu and Yi, 2004). By the early 2000s, 95% of the rural population lacked any form of coverage for health services (Babiarz et al., 2010, Yip and Hsiao, 2009). Consequently, an increasing number of the Chinese population cannot afford healthcare services. In 1993, around 5.2% of the Chinese people reported that they could not afford outpatient care when they were sick. This percentage increased to 13.8% in 1998 and to 18.7% in 2008 (Gu, 2008).

The New Cooperative Medical Scheme (NCMS) was launched in 2003 in response to the deterioration in access to health services in rural areas. The NCMS is a voluntary health insurance program heavily subsidized by the government and administered by county-level government agencies. The main goal of the scheme is to improve the rural population's access to health services by alleviating the financial burdens of paying for healthcare. Although deriving its name from its predecessor, the NCMS has a number of distinct features. First, the program is largely subsidized by the government, and the individual subscriber's contribution to the premium is relatively low. In many regions subscribers are expected to contribute only about 10 RMB per person per month; remaining costs are covered by central and local governments. Second, participation in NCMS provides rural residents access to a range of healthcare facilities, from village clinics to municipal hospitals, although the reimbursement rates for health services received differ from one facility to another. Third, NCMS is administered at the county level, such that while it offers the economic benefits of pooling across participants (unlike the old rural cooperative medical scheme), significant disparities in available coverage can arise across different counties. For example, in the more affluent eastern and coastal region, local governments are able to upsize national government subsidies to offer more comprehensive coverage to their residents (Barber and Yao, 2011, Lei and Lin, 2009). Its expansion since inception is truly remarkable: by 2012, the NCMS covered 97.5% of rural population in China, some 832 million people, making it arguably the largest health insurance program in the world (China Daily, 2012).

Despite its rapid expansion, the impact of the NCMS on reducing rural residents' financial burdens in paying for healthcare should not be taken for granted. Some studies reported that medical expenditures and OOP payments, especially for catastrophic illnesses, have indeed decreased since the program was inaugurated (Wagstaff et al., 2009a, Wagstaff et al., 2009c, Tan and Zhong, 2010, Babiarz et al., 2012), but other researchers found that out-of-pocket (OOP) payment for health services remained a severe financial burden for participating rural

households and the financial protection provided to participants was rather limited (Sun et al., 2010, Zhang et al., 2010).

Moreover, it was documented that the current provider payment mechanism based on fee-for-service (FFS) system may give perverse incentives to providers and were not conductive to cost containment (Li et al., 2011). Since most healthcare facilities relied heavily on drug revenue and the provision of health services to survive (Latker, 1998, Yip and Hanson, 2009, Yip and Hsiao, 2008), insurance such as the NCMS may further exacerbate the situation. For instance, an alarming increase in Caesarean section rates and costs occurred in rural areas after the NCMS was launched (Bogg et al., 2010). Studies likewise found that over-prescription of antibiotics in village clinics was common for patients covered by the NCMS (Sun et al., 2009, Bogg et al., 2010). Village clinics and township health centres in counties covered by the NCMS tended to generate more revenues than similar facilities in counties not participating in the program (Babiarz et al., 2012), and the care delivered at participating facilities was also found to be more costly and more sophisticated than medically necessary (Wagstaff and Lindelow, 2008).

From 2007 onwards, the NCMS started to include outpatient care in the benefit package in order to improve utilization of outpatient care—the most frequently used and widely accessible care for the rural farmers. The program has since become more comprehensive: since 2007 coverage has expanded from mainly catastrophic illnesses to outpatient (Xinhua, 2012). Two main categories of catastrophic outpatient care are eligible for reimbursement. These include: (1) general chronic conditions, such as hypertension (phrase I and II), heart disease complicated by heart failure, coronary heart disease (myocardial infarction), cerebral haemorrhage and cerebral infarction convalescence, etc.; (2) severe chronic conditions that require specialist care, such as aplastic anaemia, leukaemia, haemophilia, severe mental illness, cancer chemotherapy, chronic renal insufficiency, dialysis, organ transplant anti-row treatment for valvular heart surgery, vascular stent implantation, etc. (Hao and Yuan, 2009, Hu et al., 2008, Ministry of Health of Shandong Province, 2008, Ministry of Health of Guangxi Province, 2007, Ministry of Health of Hei Long Jiang Province, 2009). For catastrophic outpatient costs, the average reimbursement rate as claimed by the government is around 70% at village clinics and township health centres, and 40% at township hospitals and above (Xinhua, 2007), although actual reimbursement rates are much lower than claimed rates. Further, from 2007 onwards, many provinces have started to reimburse general outpatient care. The reimbursement rate is around 40% according to the government (Hao and Yuan, 2009, Hu et al., 2008).

Previous studies of the NCMS mainly focused on inpatient care, and little is known about the impacts of this new initiative on outpatient care use in rural areas. It was evident that social health insurance in China may induce unnecessary use of healthcare (Yip et al., 2010, Wagstaff et al., 2009b, Tang et al., 2012), but whether the expanded benefit package may lead to cost escalation of outpatient use is still unclear. Further, the attempt to conduct an impact evaluation of the NCMS on health costs is not as strong as it could be. Some studies offered descriptive analysis by looked at average health expenditures or expenditure increase before and after insurance; however, more rigorous methods are need, such as modeling on multivariate regression analysis of individual-level data, to isolate or control other factors which might influence health costs, or to pinpoint how much health costs or inappropriate use is associated with supply-induced demand because of the existence of insurance. To shed light on these issues, we trace the effects of NCMS on the costs of outpatient care in data from the China Health and Nutrition Survey (CHNS) of 2004 and 2009. Our study aims at addressing these gaps by focusing on three research questions:

1) Did the costs of outpatient care reduce from 2004 to 2009?
2) What effects did the NCMS have on the costs of outpatients care after outpatient care was included in the NCMS benefit package in 2007?
3) How did patterns of costs for outpatient care differ among different types of healthcare facilities?

## 2. Methods

### *2.1 Data source*

CHNS, the data source for the analysis presented here, is a continuing longitudinal household survey conducted jointly by the Carolina Population Center (U.S.) and the National Institute of Nutrition and Food Safety of China (North Carolina Population Center, 2009). Nine provinces varying substantially in terms of geography, economic development, public resources, and health indicators were included in the survey: Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou (Figure 1). A multistage cluster sampling is used to randomly draw households from the nine provinces. The CHNS surveys contain questions on socioeconomic status, health outcomes and health services utilization, insurance coverage, medical providers, and health facilities that a household might use under selected circumstances, as well as questions about accessibility of services, time and travel costs, and perceived quality of care (North Carolina Population Center, 2009).

[FIGURE 1 ABOUT HERE]

The survey data are ideal for our purposes because the survey (2004 and 2009) covered virtually the entire period from the inception of NCMS in 2003 through the early years after its expansion in outpatient coverage in 2007. Table 1 shows the rapid expansion of NCMS from 2004 to 2009: fewer than 5% the rural residents surveyed were covered by NCMS in 2004, but by 2009 more than 90% subscribed. Among the nine provinces surveyed by the NCMS, four provinces (Henan, Hubei, Liaoning, and Guangxi) started to reimburse catastrophic outpatient care since 2007. By 2008, all the surveyed provinces included catastrophic healthcare in the NCMS benefit package, and general outpatient services in the NCMS benefit package (MoH of Hei Long Jiang Province, 2009, People's Daily, 2009, MoH of Guangxi Province, 2007, MoH of Shandong Province, 2008, Hao and Yuan, 2009, Hu et al., 2008).

[TABLE 1 ABOUT HERE]

***Variable specifications***

The dependent variables are the occurrence of outpatient costs, and the pre-reimbursement (total outpatient costs before insurance claims were made) and post-reimbursement (OOP payments after insurance claims were made) per episode outpatient costs. Health payment is for a 4-week window in the CHNS. Individuals are asked to report their health payment for outpatient care and the percentage that can be reimbursed by the NCMS. We use these two variables to construct pre- and post-reimbursement per episode outpatient costs. Because the inflation rate is quite high in China, costs are adjusted according to the Consumer Price Index (CPI) for health services. According to *China Statistical Yearbook* 2005 and 2010, using 2009 as the base year, CPI for 2004 is 0.927 (National Bureau of Statistics of China, 2005, National Bureau of Statistics of China, 2011) .

Aside from the policy variable of interest—participation in NCMS, the model considers a set of factors that may influence utilization and costs of outpatient care. This includes both need and non-need variables of the sample population, as commonly suggested and used in the literatures (Hernandez Quevedo and Jimenez Rubio, 2009, Gravelle et al., 2006, Jones, 2007). For health need variables, we control for age, gender, and morbidity type. Morbidity is categorized into four types: Type 1 is no symptoms; Type 2 is fever, sore throat, cough, diarrhoea, stomach ache, headache, and dizziness; Type 3 is joint pain, muscle pain, rash, dermatitis, and eye/ear disease; Type 4 is other communicable and non-communicable diseases. For non-need factors, we control for household per capita income, education, job status, and province of residency, and season. Per capita income is constructed by using Equivalence Scales (Citro et al., 1995). Education is categorized into four groups: no

education, primary and secondary education, high school and technical school education, and university education and above. University education and above are used as the reference group. Health facilities are categorized into five groups: village clinics, township hospitals, county and city hospitals, private clinics, and other health facilities. Village clinics are the reference category. For the province variable, province Guizhou is set as the reference group. Season is categorized into two groups, late autumn to early winter (October to December), and late winter to early spring (January to March). Late winter to early spring is the reference group. Table 2 provides descriptive statistics of the data set used in the analysis.

[TABLE 2 ABOUT HERE]

***Empirical strategies***

***Mean comparison using longitudinal features of the data***

Three modelling approaches are used to estimate the impacts of NCMS on the cost of outpatient care. First, we use the panel structure of the CHNS survey to conduct a comparison of average per episode outpatient costs for a single group of individuals over time, between 2004 (when none participated in NCMS) and 2009 (when all participated in NCMS). The CHNS is an unbalanced panel. Using the whole sample for mean comparison may cause selection bias, because it studies aggregate data, and individuals are not compared with themselves.

In this analysis, it was noted that a total of the 1,954 individuals surveyed in 2004, when none participated in the NCMS, were re-interviewed in 2009, when all were covered by the NCMS (Table 3). Among these individuals, 186 of them reported outpatient cost data in 2004 and 2009. We conducted a mean comparison based on the same individuals who had outpatient costs data in both survey periods, and who were uninsured in 2004 and insured in 2009. By using the methods, we were able to control for unobservable individual factors of the sample that are consistent through time. Table 4 presents the descriptive analysis of the sample characteristics. Two samples were identical in most of the key variables that may influence health use and health costs.

[TABLE 3 ABOUT HERE]
[TABLE 4 ABOUT HERE]

***2PM and HSM***

To estimate the determinants of the use, total costs, and OOP payments for outpatient care, pooled data from two rounds of CHNS to date (2004 and 2009) are subjected to a regression

analysis with a 2PM that were used extensively in the health economics literature (Gravelle et al., 2006, Jones, 2007, O'Donnell et al., 2008). The regression analysis draw data from the CHNS of 2004 and 2009 and included all NCMS insured individuals and those who are not insured by any scheme, excluding only individuals in the sample who are participants in other insurance schemes.

The 2PM model comprises a Probit Model for the probability that an individual has any outpatient costs and an Ordinary Least Squares (OLS) model, applied only to the subsample with nonzero expenditures, to estimate correlates of the positive level of expenditure. Given that typically the distribution of health costs is right-skewed, invariably the log of expenditure is modelled in the second part OLS. Assume that the probability that outpatient cost $(y_i)$ is positive is determined by observable $(X_{1i})$ and unobservable $(\varepsilon_{1i})$ factors. Let $\ln(y_i)$ be the log of positive outpatient costs, with a set of control variables $X_{2i}$, and unobservable factors $\varepsilon_{2i}$. The model can be written as follows:

(1) $E[\ln(y_i) \mid y_i > 0, X_{2i}\beta_2] = E[\ln(y_i) \mid X_{1i}\beta_i + \varepsilon_{1i} > 0, X_{2i}\beta_2] = X_{2i}\beta_2$

While the 2PM assumes that two independent decisions lie behind medical expenditures, HSM allows the decision that seeking medical care and the choice of how much to spend can be influenced by distinct but correlated observable and unobservable factors. In the latent variable form, the model is given by the following:

(2) $y_{ji}^{*} = X_{ji}\beta_j + \varepsilon_{ji} \qquad j = 1,2$

(3) $y \begin{cases} y_{2i}^{*} & if \quad y_{1i}^{*} > 0 \\ 0 & otherwise \end{cases}$

Assuming the two error terms are jointly normally distributed, the model can be estimated by the Heckman two-step procedure. The first step involves estimating a Probit Model for the probability of nonzero expenditures, using the results to estimate the Inverse Mills Ratio (IMR) to correct for selection bias. In the second step of the model, the following is estimated:

(4) $y_i = X_{2i}\beta + \rho\sigma_2 \dfrac{\phi(X_{1i}\hat{\beta}_1)}{\phi(X_{1i}\hat{\beta}_1)} + e_{2i}$

Where $\rho$ is the correlation coefficient between the errors, and $\sigma_2$ is the standard deviation of $\varepsilon_{2i}$ $(\sigma_1 = 1)$. The performance of Heckman Selection Model depends on the collinearity between the IMR and the explanatory variables in the regression equitation, and this can be tested using a *t*-ratio test.

***PSM with DID estimation***

DID is also used to measure the effect of the change of health costs induced by the NCMS. DID represents the difference between the pre-post, within-subject differences of the treatment group and control group. In order to identify treatment and control groups, we would need data on the same individual in both 2004 and 2009, or we would be able to identify the surrogate control and treatment group if we treat the dataset as repeated cross-sectional data. However, as the CHNS is an unbalanced panel, we are not able to identify the surrogate control and treatment group among the individuals participated only in 2004 survey but not 2009 survey. Given the difficulty in identifying surrogate treatment group, DID is conducted on the same individual who were both surveyed in 2004 and 2009. Treatment group is defined as those who were not covered by the NCMS in 2004, but were covered by the NCMS in 2009. Control group was defined as those who were not covered by any insurance in either 2004 or 2009. Let $t$ = 0 represents 2004 and $t$ =1 represent 2009. The model can be written as follows,

(5) $\ln(y_i) = \beta_0 + \beta_1 X_i + \beta_2 T_t + \beta_3 X_i * T_t + \varepsilon_{it}$

Where $X_i$ is the dummy variable taking the value of 1 if the individual is in the treatment group and 0 if the individual is in the control group, and $T_t$ is a dummy variable taking the value of 1 in 2009 and 0 in 2004.

The premise of using DID is that the treatment is randomly assigned in the population. PSM is used to avoid selection bias and to ensure that all the observations are similar and randomly selected for receiving the NCMS. PSM estimates the effect of the NCMS, by accounting for the covariates that predict receiving the NCMS (Rosenbaum and Rubin, 1983). It constructs counterfactuals on an assumption that the participation in the NCMS is based on a set of observed characteristics. The method first predicts a conditional probability of participating in the NCMS given certain observable variables. It then matches each participant to one or more nonparticipants on the given propensity score using Kernel Function. Balancing properties of the matching is reported in Appendix 1. It shows that the estimated propensity score balance the observed characteristics well. One concern with regard to PSM is that it only takes into account the selection biases based on observed characteristics. Combing PSM with DID, we will be able to remove the selection bias resulting from unobserved characteristics are constant over time.

For all analyses, the computation of VIF was performed, and results indicated that multicollinearity was not a problem. Ramsy RESET tests were also performed, and results showed the models had no specification problems.

## 3. Empirical results

The comparison of per episode outpatient costs for the same group of individuals in 2004 (pre-enrolment) and 2009 (as participants to NCMS), are presented in Table 5. The average gross per episode outpatient costs (total billings per episode before insurance claims were filed) were 308.14RMB in 2009, much higher than in 2004, when the individuals studied were not covered by the NCMS ($t$ = -1.86). No significant difference was observed after the insurance claims were filed between the NCMS participants and the uninsured.

[TABLE 5 ABOUT HERE]

Table 6 shows how per episode costs for outpatient care at different levels of health facilities differed for the insured and the uninsured. Gross per episode outpatient costs, before insurance claims are filed, are significantly higher for the insured patients if care is sought at village clinics, township health centres, and private clinics rather than larger facilities. For care sought at village clinics, gross per episode costs before insurance claims are filed are 116.68RMB, which are 44.47RMB higher than gross costs billed to the uninsured ($t$ = –1.92). Similarly, gross per episode costs for the insured at village clinics are 349.39RMB, which is 201.09RMB higher than gross billings to the uninsured ($t$ = –2.05). However, after claims are paid, no significant difference is observed in the net costs between the insured and the uninsured. For care sought at the higher-level health facilities (county and city hospitals), no significant difference is observed in costs between the insured and costs to the uninsured.

[TABLE 6 ABOUT HERE]

Table 7 shows the results for 2PM and HSM. The models estimate the impacts of the NCMS on outpatient costs by comparing gross costs before insurance claims are filed with net costs after insurance claims are filed and reimbursement is paid. Occurrence of outpatient costs is analysed in relation to insurance, type of illness, job status, and place of residence, etc. Results from this second method are consistent with the regression results presented above. One salient finding is that the NCMS had no significant impacts on outpatient care utilization. Even more importantly, *ceteris paribus*, the NCMS has no effects on reducing participants' post-reimbursement outpatient payments (indicated under 'net after claim paid' column in Table 7), and meanwhile it significantly increased the pre-reimbursement outpatient costs (indicated under 'gross billed' column in Table 7). Both 2PM and Heckman Selection Model show that pre-insurance costs of outpatient care for rural residents covered by NCMS are more than 40% higher than for the uninsured. Further, it is also noted that comparing to minor

illness (Morbidity type 1), people who are with major illness are more likely to seek outpatient care.

[TABLE 7 ABOUT HERE]

Table 8 shows that the PSM with DID estimates for outpatient costs. The results show a trend of an observed increase in pre-reimbursement outpatient costs (gross billed) between the treatment and control group (*p <0.1)*. The results also show that there is no significant difference for post-reimbursement outpatient costs (net after claims paid) that were between the control and treatment groups after the NCMS was launched.

[TABLE 8 ABOUT HERE]

**Robustness tests**

We perform two main sets of robustness tests for the analysis. The first set of robustness test is performed by using both 2PM and HSM to estimate the probability of using outpatient care and main factors that influence outpatient costs. These two models show similar results. The second set of robustness test is performed on the continuous part of the regression model. The positive association between education and health is well established (Ross and Wu, 1995). In the main analysis, education is categorised into four groups (who responded 1: 'no education', 2: 'primary and secondary education', 3: 'high school or technical school', 4: 'university education and above'). For the robustness checks, these groups are re-categorised into five groups (who responded 1: 'no education', 2: 'primary education', 3: 'secondary education', 4: 'high school or technical school', 5: 'university education and above'). The regression model is then re-estimated. Robustness tests confirm the results from the 2PM and HSM models that outpatient costs are higher for the NCMS insured groups compared with the uninsured group before insurance claims are filed. No significant difference is observed for these two groups in terms of costs after insurance claims are filed.

## 4. Discussion and conclusion

The study has yielded some compelling new findings regarding the impact of the NCMS on the costs of outpatient care in rural China. Our findings indicate that outpatient treatments for the program's participants incurred significantly higher per episode costs than outpatient treatments for the uninsured after the new initiative was implemented. This pre-reimbursement inflation in costs of service is most noticeably observed at village clinics, township hospitals, and private clinics. Cost inflation for health insurance is not new and has

been observed in countries other than China. In Chile, the availability of private health insurance led to increased use of high-tech obstetric practices and consequently to higher Caesarean delivery rates (Murray and Elston, 2005). Prescription drug insurance likewise had positive effects in encouraging the use of specialist care (Allin and Hurley, 2009). In China, cost escalation was observed in the urban health insurance scheme, adopted some years before the NCMS was inaugurated for the rural population. All these programs created strong incentives for health providers to prescribe expensive drugs and high-technology diagnosis procedures, on which the profit margins were higher (Wagstaff and Lindelow, 2008).

Our analysis shows that during the interval covered by our study (2004-2009), one possible explanation for the observed increase in outpatient costs is that the availability of funds through patients' insurance claims from NCMS may similarly have induced participating health facilities and doctors to prescribe more expensive drugs or order unnecessary treatments—one phenomenon that has been recognised in the existing literature (Yip et al., 2010, Yip and Mahal, 2008, Wagstaff and Lindelow, 2008). Comparison of average per episode costs for outpatient care before and after rural residents subscribed to the NCMS yields similar findings. It appears that the NCMS is associated with an escalation in pre-reimbursement per episode outpatient health costs (gross billings, before claims are filed) for its participants, even if claims filed reduce the OOP payments to a level similar to the nonparticipants. The regression analysis and DID analysis also reveal that the pre-reimbursement costs for outpatient care for the NCMS participants are higher than those for the uninsured patients. The NCMS has limited impacts on reducing outpatient costs, while costs billed to the NCMS for outpatient services may continue to rise.

One policy implication to be drawn from this scenario is that further infusions of government subsidies aimed at covering rising NCMS expenditures may simply induce further waves of cost escalation, unless the NCMS can use its leverage as purchaser and third-party payer to introduce cost-saving measures in participating health services facilities.

More crucially, pressures for cost inflation appear to be stronger in village clinics and township health centres, where rural residents are most likely to seek outpatient care, than at larger facilities. Per episode costs for outpatient care at village clinics and township health centres are significantly higher for the NCMS patients than for the uninsured. It is widely believed that cost-effective care can best be delivered at low-level health facilities that are most accessible to rural residents. The NCMS creates incentives for its participants to seek care in those health facilities; the claims reimbursement rates for care delivered in these, small local health facilities are the highest offered by the program. Yet these small health facilities

receive less government subsidization through the NCMS than others do, usually larger health facilities. The resulting financial vulnerability, coupled with the local availability of at least some the NCMS funding, may have led to higher charges for participants as local facilities struggled to make ends meet. Much of the government support intend to subsidise participants' payments for healthcare may instead have been absorbed by the insatiable quest for revenues and cost coverage at these smaller health facilities that are most frequently visited by rural residents.

Given these considerations, it is not surprising that the rapid expansion of the NCMS through massive injection of government subsidies has so far had limited impacts on either improving access or reducing OOP payments for outpatient care at participating health facilities. In fact, our analysis indicates that rural residents covered by the NCMS are less likely to seek outpatient care than those uninsured residents who did not subscribe to the program. There is no evidence from our analysis that the NCMS has reduced OOP payment for outpatient care. Providers, seeking to offer more care, ultimately increase total costs of outpatient care, such that financial benefits to patients in the form of claim reimbursements through the NCMS are largely dissipated by the costs of this enhanced service, providing no overall cost savings to outpatient participants.

In thinking of the policy implications, we must bear the limitations in mind. The first concerns the dataset. The dataset used is probably by far the most comprehensive ever used in studying health inequality in the Chinese context; however, only nine provinces are included. Most of these provinces are situated in the eastern and coastal part of China, where the levels of economic development are high. Hence, any further generalisation should be made with caution. Secondly, outpatient costs are influenced by supply as well as demand. Because the CHNS survey does not include specific data on some potentially important factors influencing the supply side, such as number of doctors in a health facility, ownership structure of health facilities, and number of health facilities in specific localities, the effects of these factors on the costs of outpatient care could not be assessed in our analysis. The third limitation is that the recall period of healthcare use is only 4 weeks. This might be problematic because the stochastic nature of healthcare needs means that they might be sufficiently captured by a 4 weeks window (O'Donnell et al., 2008).

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**Table 1Sample NCMS participants/non-participants covered by CHNS Survey years**

| Year | Uninsured (%) | Insured (%) | Total |
|---|---|---|---|
| 2004 | 4,139 (95.79) | 182 (4.22) | 4,321 |
| 2009 | 280(6.86) | 3,804 (93.14) | 4,084 |

**Table 2 Descriptive statistics for the study population (mean/standard deviation)**

| Variable | Definition | Mean | Std. Dev. |
|---|---|---|---|
| Need variables | | | |
| Age | | 46.481 | 14.571 |
| Gender | Dummy variable: 1, Male; 0 Female | 0.503 | 0.500 |
| Morbidity type 1* | Dummy variable: 1, fever, sore throat, cough, diarrhea, stomachache, headache, and dizziness; 0 otherwise | 0.821 | 0.384 |
| Morbidity type 2 | Dummy variable: 1, joint pain, muscle pain, rash, dermatitis, and eye/ear disease; 0 otherwise | 0.088 | 0.284 |
| Morbidity type 3 | Dummy variable: 1, infectious disease; 0 otherwise | 0.045 | 0.208 |
| Morbidity type 4 | Dummy variable: 1, non-communicable diseases; 0 otherwise | 0.046 | 0.209 |
| Non-need variables | | | |
| Per capita income | Per capita household income is inflated to year 2009 | 9.527 | 0.869 |
| Job status | Dummy variable: 1, Employed; 0 otherwise | 0.784 | 0.411 |
| No edu | Dummy variable: 1, No education; 0 otherwise | 0.222 | 0.415 |
| Pri/sec edu | Dummy variable: 1, Primary and secondary education; 0 otherwise | 0.620 | 0.485 |
| High school/tech edu | Dummy variable: 1, High school and technical school education; 0 otherwise | 0.129 | 0.336 |
| Uni and above edu* | Dummy variable: 1, University and above education; 0 otherwise | 0.021 | 0.144 |
| Province Liaoning | Dummy variable: 1 Liaoning, 0 otherwise | 0.118 | 0.323 |
| Province Heilongjiang | Dummy variable: 1 Heilongjiang, 0 otherwise | 0.102 | 0.302 |
| Province Jiangsu | Dummy variable: 1 Jiangsu, 0 otherwise | 0.118 | 0.323 |
| Province Shandong | Dummy variable: 1 Shandong, 0 otherwise | 0.109 | 0.312 |
| Province Henan | Dummy variable: 1 Henan, 0 otherwise | 0.098 | 0.297 |
| Province Hubei | Dummy variable: 1 Hubei, 0 otherwise | 0.108 | 0.310 |
| Province Hunan | Dummy variable: 1 Hunan, 0 otherwise | 0.086 | 0.280 |
| Province Guangxi | Dummy variable: 1 Guangxi, 0 otherwise | 0.136 | 0.342 |
| Province Guizhou* | Dummy variable: 1 Guizhou, 0 otherwise | 0.125 | 0.331 |
| Season | Dummy variable: 1 Sep. to Dec., 0 Jan. to Mar. | 0.546 | 0.498 |

Note: *reference groups.

**Table 3 Sample distribution by NCMS participation for 2004 and 2009**

| | | 2009 (*N* = 4,084) | | |
|---|---|---|---|---|
| | | Insured with NCMS | Uninsured with NCMS | Not surveyed in 2009 |
| 2004 (*N* = 4,321) | Insured with NCMS | 81 | 1 | 100 |
| | Uninsured with NCMS | 1,954 | 120 | 2,065 |
| | Not surveyed in 2004 | 1,769 | 159 | 0 |

**Table 4 Descriptive statistics for the study population for Empirical Strategy 1 (mean/standard deviation)**

| | 2004 (N =186) | | 2009 (N = 182) | |
|---|---|---|---|---|
| **Variables** | **Mean** | **Std. Dev.** | **Mean** | **Std. Dev.** |
| Age | 49.555 | 11.547 | 55.141 | 11.575 |
| Gender | 1.548 | 0.499 | 1.566 | 0.497 |
| Household expenditures | 4346.565 | 5132.607 | 4828.061 | 7003.482 |
| 4 week illness | 0.785 | 0.412 | 0.786 | 0.411 |
| Morbidity type 2 | 0.516 | 0.501 | 0.357 | 0.480 |
| Morbidity type 3 | 0.237 | 0.426 | 0.324 | 0.469 |
| Morbidity type 4 | 0.215 | 0.412 | 0.297 | 0.458 |
| Village clinics | 0.355 | 0.480 | 0.379 | 0.487 |
| Township hospitals | 0.231 | 0.423 | 0.225 | 0.419 |
| County/city hospitals | 0.188 | 0.392 | 0.198 | 0.399 |
| Private clinics | 0.177 | 0.383 | 0.154 | 0.362 |
| Other health facilities | 0.048 | 0.215 | 0.044 | 0.206 |
| Job status | 0.780 | 0.415 | 0.780 | 0.415 |
| No edu | 0.269 | 0.445 | 0.352 | 0.479 |
| Pri and sec edu | 0.608 | 0.490 | 0.604 | 0.490 |
| High school | 0.118 | 0.324 | 0.044 | 0.206 |
| Uni and above | 0.005 | 0.073 | 0.000 | 0.000 |
| Province Liaoning | 0.129 | 0.336 | 0.088 | 0.284 |
| Province Heilongjiang | 0.059 | 0.237 | 0.049 | 0.217 |
| Province Jiangsu | 0.005 | 0.073 | 0.000 | 0.000 |
| Province Shandong | 0.032 | 0.177 | 0.049 | 0.217 |
| Province Henan | 0.183 | 0.388 | 0.187 | 0.391 |
| Province Hubei | 0.220 | 0.416 | 0.104 | 0.307 |
| Province Hunan | 0.027 | 0.162 | 0.033 | 0.179 |
| Province Guangxi | 0.177 | 0.383 | 0.335 | 0.473 |
| Province Guizhou | 0.167 | 0.374 | 0.154 | 0.362 |
| season | 0.559 | 0.498 | 0.258 | 0.439 |

**Table 5 per episode outpatient costs for the insured and uninsured**

| | Uninsured (2004) ($n$ = 186) | Insured (2009) ($n$ = 182) | Difference | $t$-stat |
|---|---|---|---|---|
| Gross billed | 205.43 | 308.14 | –102.71 | –1.86* |
| Net after claim paid | 205.43 | 253.81 | –48.38 | –0.93 |

Note: *** $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$

**Table 6 Medical costs per treatment episode, for the insured and uninsured, at different levels of health facilities**

| | **Uninsured (2004)** ( *N* = 186) | **Insured (2009)** (*N* = 182) | **Difference** | ***t*-stat** |
|---|---|---|---|---|
| Village clinics | 66 | 69 | | |
| Gross billed | 72.21 | 116.68 | –44.47 | –1.92* |
| Net after claim paid | 72.21 | 97.77 | –25.56 | –1.14 |
| Township health centres | 43 | 41 | | |
| Gross billed | 139.30 | 349.39 | –210.09 | –2.05** |
| Net after claim paid | 139.30 | 244.20 | –104.90 | –1.24 |
| City/county hospitals | 35 | 36 | | |
| Gross billed | 618.12 | 683.89 | –65.77 | –0.34 |
| Net after claim paid | 618.12 | 569.72 | 48.40 | 0.26 |
| Private clinics | 33 | 28 | | |
| Gross billed | 52.31 | 289.29 | –236.98 | –2.04** |
| Net after claim paid | 52.31 | 289.29 | –236.98 | –2.04 |
| Other | 9 | 8 | | |
| Gross billed | 454.91 | 123.13 | 331.78 | 1 .00 |
| Net after claim paid | 454.91 | 103.11 | 351.80 | 1.06 |

Note: *** $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$

**Table 7 Regression results for outpatient medical costs for 2004 and 2009**

| | 2PM | | | | HSM | | | |
|---|---|---|---|---|---|---|---|---|
| | Gross billed | | Net after claims paid | | Gross billed | | Net after claims paid | |
| | Participation Probit | Continuous OLS | Participation Probit | Continuous OLS | Participation Probit | Continuous OLS | Participation Probit | Continuous OLS |
| | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient | Coefficient |
| Insurance | 0.065 | 0.343*** | 0.052 | 0.098 | 0.046 | 0.415*** | 0.052 | 0.098 |
| Age | 0.02 | 0.008 | 0.02 | 0.008 | 0.024* | 0.017 | 0.02 | 0.008 |
| Age2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gender | -0.133** | 0.085 | -0.107* | 0.117 | -0.131** | -0.044 | -0.107* | 0.115 |
| Morbidity type 2 | 2.558*** | -0.534** | 2.538*** | -0.428* | 2.534*** | 2.245*** | 2.538*** | -0.377 |
| Morbidity type 3 | 2.15*** | 0.106 | 2.17*** | 0.214 | 2.154*** | 2.503*** | 2.17*** | 0.259 |
| Morbidity type 4 | 2.62*** | 0.957*** | 2.621*** | 1.039*** | 2.63*** | 3.77*** | 2.621*** | 1.091 |
| Per capita income (lg) | 0.031 | -0.044 | 0.017 | -0.023 | 0.037 | -0.024 | 0.017 | -0.022 |
| Job status | 0.083 | 0.006 | 0.091 | -0.044 | 0.073 | 0.106 | 0.091 | -0.042 |
| No edu | -0.345 | -0.75 | -0.367 | -0.756 | -0.383 | -1.017 | -0.368 | -0.762 |
| Pri and sec edu | -0.261 | -0.668 | -0.297 | -0.724 | -0.291 | -0.872 | -0.297 | -0.729 |
| High school | -0.46 | -0.616 | -0.495 | -0.597 | -0.487 | -0.996 | -0.496 | -0.605 |
| Province Liaoning | -0.279** | 0.944*** | -0.285** | 1.077*** | -0.289** | 0.709*** | -0.285** | 1.072*** |
| Province Heilongjiang | -0.379** | 0.619** | -0.375** | 0.504 | -0.386*** | 0.273 | -0.375** | 0.497 |
| Province Jiangsu | 0.184 | 0.483** | 0.203 | 0.668*** | 0.154 | 0.675** | 0.203 | 0.671** |
| Province Shandong | 0.003 | 0.41 | 0.025 | 0.139 | -0.023 | 0.464 | 0.025 | 0.14 |
| Province Henan | 0.37*** | 0.027 | 0.384*** | 0.181 | 0.371*** | 0.346 | 0.384*** | 0.187 |
| Province Hubei | 0.092 | 0.409* | 0.017 | 0.447* | 0.064 | 0.537** | 0.017 | 0.448* |
| Province Hunan | -0.074 | 0.778*** | -0.134 | 0.906*** | -0.092 | 0.723** | -0.134 | 0.903*** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Province Guangxi | 0.459*** | 0.096 | 0.425*** | 0.266 | 0.424*** | 0.534** | 0.425*** | 0.273 |
| Season | -0.272*** | 0.114 | -0.328*** | 0.046 | -0.272*** | -0.118 | -0.328*** | 0.041 |
| Constant | -3.063*** | 4.758*** | -2.883*** | 4.488*** | -3.159*** | 0.594 | -2.882*** | 4.41* |
| | N = 7717 | N = 730 | N = 7717 | N = 711 | N = 7717 | N = 730 | N = 7717 | N = 711 |
| | LR chi2(21) = 2547.26 | F( 21, 708) = 9.65 | LR chi2(21) =2487.31 | F( 21, 689) = 7.5 | Rho = 0.7696349 | | Rho = 0.0174707 | |
| | Prob > chi2 = 0 | Prob > chi2 = 0 | Prob > chi2 = 0 | Prob > chi2 = 0 | LR test of Rho = 0: $p$ = 0.0133 | | LR test of Rho = 0: $p$ = 0.9706 | |
| | Pseudo R2 = 0.5272 | R2 = 0.2042 | Pseudo R2 = 0.5242 | R2 = 0.186 | Wald chi2(21) = 175.23 | | Wald chi2(21) = 161.65 | |
| | | | | | Prob > chi2 = 0 | | Prob > chi2 = 0 | |

(Note: *** $p$ < 0.01, ** $p$ < 0.05, *, $p$ < 0.1)

**Table 8 DID results with PSM for outpatient costs before the NCMS deduction and after the NCMS deduction**

| | Before reimbursement (N = 351) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Control | Treated | Diff(2004) | Control | Treated | Diff(2009) | Diff-in-diff |
| **Outpatient cost (lg)** | 5.108 | 4.146 | -0.962 | 3.854 | 4.668 | 0.814 | 1.777* |
| **S.E.** | 0.567 | 0.124 | 0.581 | 0.926 | 0.122 | 0.934 | 1.1 |
| **$R^2$** | | | | | | | 0.238 |
| | **After Reimbursement (N = 344)** | | | | | | |
| | Control | Treated | Diff(2004) | Control | Treated | Diff(2009) | Diff-in-diff |
| **Outpatient cost (lg)** | 3.976 | 4.141 | 0.165 | 4.390 | 4.402 | 0.012 | -0.153 |
| **S.E.** | 0.547 | 0.128 | 0.561 | 0.669 | 0.126 | 0.681 | 0.883 |
| **$R^2$** | | | | | | | 0.233 |

(Note: *** $p < 0.01$, ** $p < 0.05$, *, $p < 0.1$. DID model used include age, gender, morbidity types, *per capita* income, job status, province and season variables. )

**Figure 1. Map of Survey Regions**